QUARTERLY SUMMARY

OF THE

IMPROVEMENTS AND DISCOVERIES

IN THE

MEDICAL SCIENCES.

ANATOMY AND PHYSIOLOGY.

1. *On the Relation of Respiration to Muscular Action, and on the General Significance of Respiration.*—By Dr. MORITZ TRAUBE. The author first shows that the division of food into tissue-forming and respiratory (according to Liebig's hypothesis) is negatived by the fundamental conditions of animal life. It is wrong to suppose that the consumption of material in animals, as expressed in the respiration, suffices merely for heat production. In respect to the whole range of the animal kingdom, including cold-blooded creatures, one may rightly conclude that the most important function of respiration is the maintenance of muscular activity. The experiments of Lavoisier, and of Regnault and Reisel, prove that, with increase of exercise (muscular movement), an increased amount of oxygen is consumed. By a comparison of torpid, half-torpid, and active lizards, this law was strikingly demonstrated. Pathology shows that any deficiency of respiration (*e. g.*, in certain heart diseases) brings with it the incapacity for muscular activity. The question arises: Into what element of the muscle does the oxygen of the blood fix itself? is it diffused in the fluid of muscle? or is it associated with the muscular fibre itself?

As the blood passes through the capillaries, a portion of the oxygen is set free; this passes through the walls of the vessels, and joins the muscular fibre in the form of an unstable chemical combination, which is capable again of giving up its oxygen to another matter, which is present in the fluid of muscles, and which has a stronger affinity for oxygen than the muscular fibre. The latter is again in a condition to take up a fresh portion of oxygen. This theory the author has developed in a previous work.[1] The combinations formed in the fluid of muscles the author seems to regard as a transition product (Zwischenproduckt) towards water and carbonic acid. This transference of oxygen is effected more rapidly at high than at low temperatures, in warm-blooded than in cold-blooded animals. The deoxidation of the muscular fibre goes on most rapidly under the action of the nerves, but in a manner not yet explained. Since an active muscle by its oxygen oxidizes, in a given time, more combustible material, and consequently produces more carbonic acid, than during the conditions of rest, so must the increased amount of carbonic acid derive more oxygen from the arterial blood. In long-continued hard labour so much oxygen may be used that the respiratory apparatus is put into most active exercise. Perfect deoxidation of the muscular fibre corresponds with *post-mortem* rigidity; consequently, we find that heat hastens and cold retards rigidity. Muscular action has the effect of hastening rigidity, whilst the contact of oxygen again dispels

[1] Theorie der Fermentwickungen. Berlin, 1858.

(Brown-Sequard and Stannius). The experiments of Humboldt, Liebig, and Brown-Sequard, taken collectively, prove that the *post-mortem* rigidity of muscles is produced by the want of free oxygen. According to Traube, the muscular fibre, or rather the fibrinous matter contained in it, is a vital ferment, which transports oxygen from the blood-substances dissolved in the fluid of muscle. From the above theory, the following consequences may be deduced: The muscles in their quiescent state minister to the process of respiration, since they hand over the oxygen of the blood to combustible materials, and reduce the latter—with the formations of heat—to carbonic acid and water. The transitional combustible matters consist, according to Helmholtz, of substances soluble in alcohol; but, according to Du Bois Reymond, of acids. The muscles, then, may be considered as the principal seats of combination and heat-production. The organized part of the muscle is not disturbed in its function. The theory of Liebig, that the albuminous substances, by their chemical changes, are chiefly concerned in supporting muscular activity, is not borne out by the above conclusions, for non-nitrogenous substances may be equally serviceable, and the urea thus furnishes no estimate for the developed muscular force. From experiments of Bischoff and Voit, it results that the destruction of albuminous substances has nothing to do with the muscular action of the animal organism, but it is highly probable that the decomposition of albumen is effected by a ferment in the liver. The bile, from its contained nitrogen and sulphur, unmistakably indicates its origin. Kühne and Hallwachs have proved[1] that the seat for the conversion of non-nitrogenous benzoic acid into nitrogenous hippuric acid is the liver. The experimentum crucis which proves that the albumens do not participate in muscular action is that of Voit, in which, after extreme muscular action, the excretion of urea was shown not to be increased. It has been shown that increased muscular action requires consumption of oxygen, and that a quantity of matter in muscles is consumed. Did this matter consist of the muscular fibre itself, or of the albumen in the fluid of muscle, then, after increased muscular action, we ought to find much urea in the urine, which is not the case. Although the albumens take no part in muscular action, their presence is very important. They alone are capable of forming the various ferments, of sustaining the growth of organs, and of repairing the loss of substance. They are necessary for the maintenance of mucous membranes, bones, epidermis, nails, hair, etc. They are also required for the *organized* parts of muscle. The decomposition of albumen is essential to the formation of bile. In the carnivorous animals it must also serve for heat formation and for muscular activity. But Liebig has introduced an error in dietetics, in estimating the worth of nutriment by the proportion of nitrogen contained in it. The most striking contradiction to this supposition is furnished by the herbivorous animals, many of which are remarkable for their capabilities for prolonged labour.

After some remarks on respiration, Traube sums up the functions of that act under the three following heads: 1. The respiratory process is necessary for cell formation: This is its most general function, because all organized beings, plants as well as animals, require oxygen for the construction of cells; in plants, this is the only use of respiration. 2. Muscular activity: This function is common to warm-blooded as well as to cold-blooded animals; in the latter, muscular activity is the most important object of respiration. 3. Heat production: Although this function requires the greatest consumption of oxygen, yet it is only in warm-blooded animals that it has the signification of a truly vital process.—*Edinburgh Medical Journal,* Nov., 1861, from *Archiv. für Patholog. Anat. und Physiologie.*

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2. *Influence of Water on the Metamorphosis of Matter.*—Dr. FREDERICK MOSLER, of the University of Giessen, has recently instituted a series of experiments on the influence of common drinking-water, taken in various quantities, upon the general metamorphosis of matter in the human body, which have led to important results. The experiments were made on a number of men, women, and children; in one series the food and the general mode of living remained un-

[1] Pharmac Centralbl., 1857, s. 359.